

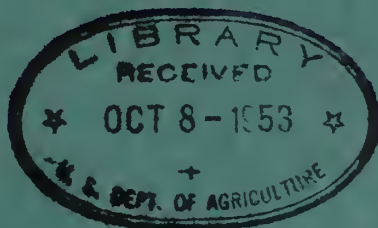
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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

Operations Guidance Report on

WATER FACILITIES FOR

CIMARRON RIVER WATERSHED IN HARPER COUNTY

OKLAHOMA

Prepared by

WATER UTILIZATION SECTION
DIVISION OF LAND ECONOMICS

September 1939

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Under the Provisions of the
Water Facilities Act
(Public Law No. 399, 75th Congress)

September 1939

ACKNOWLEDGMENTS

This report has been prepared by the Water Utilization Section, Land Economics Division, Bureau of Agricultural Economics. The base map of the area was compiled in part from original field reconnaissance and in part from the base sheets of the Oklahoma State Highway Department. Geologic data were obtained from the United States Geological Survey base map, and Bulletin No. 40, Volume 2, published by the Oklahoma Geological Survey. Climatological data were obtained from the United States Weather Bureau. Information regarding land use and economic data was obtained from Harper County officials, Farm Security Administration, and through field reconnaissance.

AUTHORIZATION

This report has been prepared under the provisions of the Water Facilities Act, Public Law No. 399, of the 75th Congress. This area was authorized May 24, 1939, at Washington, D. C., in Water Facilities Board - Oklahoma State Memorandum No. 4, dated May 24, 1939.

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CONCLUSIONS AND RECOMMENDATIONS

1. The average annual precipitation at Buffalo, near the center of the area is 22.18 inches.
2. The estimated average annual surface run-off per square mile over the area is:
 - a. "Red bed" areas . . . 46 acre-feet.
 - b. Other areas 24 acre-feet.
3. Ground water development for both stock and domestic purposes is recommended in the Quaternary sand and alluvium areas, except along the Cimarron River in the extreme northeastern part of the area.
4. Ground water development in the "red bed" areas is recommended for stock watering purposes only.
5. It is recommended that surface water development be limited to the following:
 - a. Construction of small dams and reservoirs for stock watering purposes.
 - b. Flood irrigation of the better soil type native pastures.

CIARRON RIVER WATERSHED IN HARPER COUNTY
OKLAHOMA

PURPOSE AND SCOPE

The purpose of this report is to indicate in a preliminary manner the agricultural utilization of the available water resources.

The data contained in this report are the result of reconnaissance studies and are therefore preliminary in nature. While additional information would allow recommendations to be made in greater detail, it is believed that the recommendations herein contained are reliable and have sufficient accuracy for the purpose of pointing the direction which the action program should take.

Proposed and recommended developments are outlined and discussed in their relation to the best utilization of the available water resources in the area.

DESCRIPTION OF THE AREA

Location

The area discussed in this report consists of all lands in Harper County drained by the Cimarron River. It includes all of the county with the exception of the approximate southwestern quarter. A small part of Woodward County is also included in the area. The area lies between 36°30' and 37°00' north latitude and 99°15' and 100°00' west longitude.

Included within the area are approximately 748 square miles or 478,720 acres. The principal town is Buffalo, which is the county seat of Harper County. Solman, Doby Springs, Lovedale, Fern, and Kilby are unincorporated towns within the area.

Topography

The topography of the area varies from gently rolling to rough and undulating. Extending along the southwestern border of the area is a gently rolling upland varying from 2 to 7 miles in width. North and east of this upland, erosion has exposed the Permian formations, and produced typical "red bed" topography. A series of "red bed" hills, in the northeastern part of the area, forms the divide between Buffalo Creek tributaries and those to the Cimarron. The general slope of the land surface averages about 15 feet per mile to the east.

Elevation

Elevations vary in the area from approximately 2,050 feet in the extreme western portion to about 1,620 feet at the confluence of Buffalo Creek with the Cimarron River. Buffalo town site is approximately 1,813 feet above mean sea level. The elevation of the Cimarron River near Englewood, Kansas, about 30 miles northeast of Buffalo, is approximately 1,960 feet.

Drainage Pattern

The Cimarron River, flowing in a southeasterly direction, forms the northeastern boundary of the area. Redoubt, Snake, and Willow creeks, all tributaries to the Cimarron, drain the area north of the divide which separates the Cimarron from Buffalo Creek. The Cimarron also cuts across the northwestern corner of the area. Buffalo Creek originates in the northwest central part of the area and flows in an easterly direction to its confluence with the Cimarron in Woodward County, at a point approximately one and one-half miles east of the Harper-Woodward county line. This stream and its tributaries, including Sand and Sleeping Bear creeks, drain practically all of the area south of the Buffalo-Cimarron divide.

The Cimarron usually has a broad sand filled channel with low banks. Following heavy rains, the channel is subject to overflow, but during the greater part of the year it carries relatively little water. The tributary streams usually have narrow, sandy channels, with steep banks.

Climatological Data

The average monthly and annual precipitation at Buffalo, Oklahoma, is shown in the following table. This record is for a period of 23 years from 1914 to 1938, inclusive.

BUFFALO, OKLAHOMA
AVERAGE MONTHLY AND ANNUAL PRECIPITATION
IN INCHES
ELEVATION - 1,850 FEET

January	.61	July	2.12
February	.86	August	2.57
March	1.32	September	2.56
April	1.87	October	1.44
May	3.23	November	1.25
June	3.53	December	.82
		Annual	22.18

Geology and Ground Water Resources

Within the area described in this report are exposed beds of Permian, Cretaceous, Tertiary, and Quaternary age.

The Permian "red beds," consisting of the Upper Enid formation, Blaine Gypsum and the Woodward group, occupy the surface over the greater part of the area. The Woodward group consists of alternating shales, gypsum, and dolomites, and is the most widespread surface formation in the area. Along the Cimarron River and Buffalo Creek and central part of the area, erosion has removed the Woodward group and exposed over large areas the underlying Blaine Gypsum and Upper Enid formations. The possibilities of securing dependable supplies of good water from any of these "red bed" formations are

remote. In general, the "red beds" yield highly mineralized water in quantities sufficient for stock purposes. It is not suitable for domestic consumption. Well depths vary from 10 to 200 feet.

Rocks of Lower Cretaceous age (Washita) outcrop in four small areas in the southern part of the area. These rocks have no effect on the water supply. Likewise, sands and gravels of late Tertiary age appear at the surface over a small area, less than 2 square miles, in the extreme northwestern corner of the watershed.

Quaternary dune sands and terrace deposits occur along the southern and southwestern border of the area in a strip varying from 2 to 7 miles in width. These deposits are capable of producing potable water in quantities sufficient for both stock and domestic purposes. Wells in these deposits average 30 feet in depth.

Alluvium deposits of an unknown thickness occur along the Cimarron River in the northwestern corner of the area. Existing facilities indicate the deposits will produce potable water in quantities sufficient for stock and domestic purposes. Along the same stream in the northeastern part of the area, the alluvium deposits are impregnated with salt plains deposits, and the water occurring therein is suitable for stock purposes only.

Surface Water

The average annual discharge of the Cimarron River at Wynoka, Oklahoma, about 60 miles southeast of Buffalo, is 290,000

acre-feet.¹ This discharge results in a unit run-off of about 24 acre-feet per square mile of the 12,200 square miles in the watershed, and is equivalent to approximately 2 per cent of the average annual precipitation.

Pemian "red beds" constitute only a small percentage of the surface area included in the 12,200 square miles of drainage area down to the Waynoka gaging station. Therefore, the unit run-off as recorded at that station is not indicative of run-off over "red bed" areas. Results of discharge measurements on the Washita River at Clinton, Oklahoma, however, are indicative of this run-off, as the greater part of its watershed is covered by Permian deposits. Discharge records of this stream indicate a run-off approximating 4 per cent of the average annual precipitation. Applying this factor to the area treated by this report, the average annual run-off per square mile in the "red bed" areas will be about 46 acre-feet.

Over the remaining parts of the area, including all portions not covered by the "red beds," the average annual run-off per square mile is estimated to be 24 acre-feet.

Present Land Use

It is estimated that approximately 60 per cent of the land is in native pasture and 40 per cent in cultivation. Approximately 2

¹ Arkansas River and Tributaries, Corps of Engineers, House Document No. 308, 74th Congress, 1st Session, Vol. 2, page 1471.

per cent is abandoned cropland. Numerous abandoned houses dot the area. Some 200 acres of cropland are being irrigated along the south bank of the Cimarron River near Englewood, Kansas, by diversion and pumping from the Cimarron River.

PROPOSED UTILIZATION

Land Utilization

Many tracts are now being used for farming with a cash crop system predominating, whereas the recommended change in the pattern would be to a livestock system supplemented with cash crops as the more desirable land use. Large tracts exist which should be utilized for grazing purposes only. Land with slopes greater than 6 per cent should not be considered for crop production, and all lands with slopes between 2 per cent and 6 per cent should be contoured if used as cropland.

Water Utilization

Stock and Domestic.—It is recommended that surface water development be limited to (1) the construction of small ponds and reservoirs for stock watering purposes and (2) to flood irrigation, except from the Cimarron River, of native pastures with good soils. This type of development can be carried out over the entire area, although the "red bed" area will probably offer better opportunities on account of the topography and higher surface discharge rate. Great care should be exercised in the selection of reservoir sites because of the presence of soluble "gyp rock" common to "red bed" areas. It is not always exposed on the surface.

It is recommended that the development of ground water for combined stock and domestic purposes be limited to the Quaternary sand and alluvium areas as shown on Plate 2. Where the Permian formations comprise the surface, ground water development should be limited to stock watering purposes only. This area is also shown on Plate 2.

Numerous opportunities are presented throughout the whole area for rehabilitating existing facilities.

Irrigation

Surface Water.---Development along the Cimarron River using surface water for irrigating cropland is not recommended in view of the possibility that the Corps of Engineers¹ may revive their studies and construct a proposed dam near Englewood, Kansas. This would render any other development, along the stream in Harper County, useless.

¹ Arkansas River and Tributaries, 74th Congress, 1st Session, House Document No. 306.

